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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
HASSANZADEH, PARVIZ	
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1763	

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17

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

Office Action Summary	Application No.	Applicant(s)
	09/439,314	SANDHU ET AL.
	Examiner	**Art Unit**
	Parviz Hassanzadeh	1763

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 12 May 2003.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 41-69 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 41-69 is/are rejected.

7)☒ Claim(s) 65 and 66 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 12 November 1999 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Objections

Claims 65 and 66 are objected to because of the following informalities: on line 1 of the claims "method" should be replaced with "apparatus" because these claims are dependent of apparatus 64, 63. I is also noted that this Application is divisional application electing apparatus claims. Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 41-54 and 57-69 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bhardwaj et al (EP 0,822,582 A2) in view of Hatano (US Patent No. 5,989,345) and Redeker et al (US Patent No. 6,182,602 B1).

Bhardwaj et al teaches a plasma apparatus (Fig. 1) which is suitable for use both in reactive ion etching and chemical vapor deposition, the apparatus comprising:

a vacuum chamber 11 surrounded by a coil 15a coupled to an RF source 16 to induce a plasma in the chamber (*a second chamber, wherein the second chamber is configured to initially generate second plasma therein*), the chamber is further provided with a gas inlet port 18 through which deposition gases (such as hydrocarbons) or etched gases can be introduced into the chamber (*the chamber further configured to lose an ability to generate the second plasma*) (page 3, line 49 through page 4, line 2; page 6, lines 20-43).

Bhardwaj et al fails to teach the deposition gas including an electrically conductive material such that deposition of the byproduct on the interior surface of the chamber prevent inductive coupling of the power to the plasma.

Hatano teaches a process gas supply system (Fig. 1) for supplying a process gas into a process chamber, the system includes $TiCl_4$ (titanium tetrachloride gas) for forming Ti film on a substrate W set in a process chamber 6 (column 2, lines 51-62).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the process gas supply system as taught by Hatano in the apparatus of Bhardwaj et al in order to form a Ti film on a substrate.

Bhardwaj et al further fails to teach remote plasma source configured for providing an etching (cleaning) gas into the processing chamber for cleaning an interior surface of the process chamber (*a first chamber configured to generate a first plasma therein; wherein the second chamber is configured to receive the first plasma, wherein the first plasma is configured to restore said ability*).

Redeker et al teaches an inductively coupled plasma CVD apparatus (Fig. 1) including a remote plasma chamber cleaning system 30, wherein cleaning gases such as dissociated fluorine containing gases are introduced into a processing chamber 12 via a channel 28 for cleaning all exposed chamber surface (abstract; column 4, lines 1-22).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the remote plasma chamber cleaning system as taught by Redeker et al in the apparatus of Bhardwaj et al in order to clean the exposed chamber surface.

Further regarding claim 42: the process chamber would *inherently* lose the ability to generate plasma as deposition of Ti on the interior surface of the processing chamber would prevent inductive coupling of energy from and inductive coil 70 into the plasma within the chamber. The process chamber would *inherently* regain the ability to generate plasma as deposited Ti on the interior surface of the processing chamber is cleaned and removed by the remote plasma source.

Further regarding claims 43, 44 (tube furnace): the plasma processing chamber of Bhardwaj et al is structurally equivalent to the claimed tube furnace because it includes a chamber (tube) configured to house a high density plasma. Similarly, the remote plasma source 30 of Redeker et al is a equivalent to tube furnace because it includes an applicator tube 508 such as sapphire tube or other energy transmissive tube therein a plasma is formed by a waveguide 512 (Fig. 18; column 18, line 51 through column 19, line 5).

Further regarding claims 45, 46: "a first structure defining a furnace …" is interpreted as the processing chamber; "a first material that is opaque to the wave …" is interpreted as a

metallic material such as Ti; and "a delivery system in fluid communication ..." is interpreted as the remote cleaning plasma source.

Further regarding claims 47, 48, 49: Redeker et al further teaches that the cleaning gas may be NF_3, F_2, SF_6, ClF_3, CF_4, C_2F_6 (column 19, lines15-39).

Further regarding claims 50-53: "an induction blocker" is interpreted as Ti deposited on the interior surface of the processing chamber; "a component coupled to the first reaction device and configured to ..." is interpreted as the remote cleaning plasma source; and "an induction blocker remover" is interpreted as cleaning plasma gas introduced by the remote plasma source into the processing chamber. The processing chamber of Amens et al includes a quartz liner defining a processing chamber 25 and an induction coil 70 for generating an inductively coupled plasma within the processing chamber.

Further regarding claim 54: "a conduit configured to couple to an inductively-coupled plasma chamber" is interpreted as channel 28 in Figs. 1 and 18 of Redeker et al; "a cleaning chamber coupled to the conduit ...) interpreted as the remote cleaning plasma source introducing a cleaning plasma gas into the processing chamber.

Further regarding claims 57, 60: "a reactor having a wafer fabrication mode ..." or "a furnace comprising a quartz tube ..." is interpreted the processing chamber; "a chamber configured to couple to the reactor during cleaning mode ...) or "a cleaning chamber ..." is interpreted as the remote cleaning plasma source introducing a cleaning plasma gas into the processing chamber.

Further regarding claim 58, 61, 62: removing the wafer from the processing chamber during cleaning is considered a process limitation and the apparatus of Amen I view of Redeker et al is capable of being used under the condition as recited in the claim.

Further regarding claim 59: "the chamber is configured to transmit said metal etchant in a non-plasma form from to said reactor during said cleaning mode" is considered a process limitation and the apparatus of Amen I view of Redeker et al *is capable of being operated* under the condition as recited in the claim by simply introducing the etchant through the remote cleaning plasma source without applying a plasma generating energy to the etchant.

Further regarding claims 63-66: "a conductive material present ..." is interpreted as Ti deposited on the interior surface of the processing chamber; "a first plasma chamber" is interpreted as the remote cleaning plasma source.

Further regarding claims 67-69: "a first material that is opaque to a type of energy to an RF wave" is interpreted as Ti deposited on the interior surface of the processing chamber; "a plasma delivery system ..." is interpreted as the remote cleaning plasma source which is used remove that Ti which is deposited on the interior surface of the processing chamber.

Claims 55, 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bhardwaj et al (EP 0,822,582 A2) in view of Hatano (US Patent No. 5,989,345) and Redeker et al (US Patent No. 6,182,602 B1) as applied to claims 41-54 and 57-69, and further in view of Kumagai (US Patent No. 5,916,455).

Bhardwaj et al in view of Hatano and Redeker et al teaches all limitations of the claims as discussed above except for the plasma generation device for the remote plasma source

(cleaning chamber) being an inductively coupled plasma source rather than a microwave plasma source.

Kumagai teaches a plasma processing apparatus (Fig. 1) including a remote ignition plasma source 30 wherein an inductive coil 37 coupled to an RF power source 40 is used for generating a plasma (column 4, lines 8-29).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the inductive plasma device as taught by Kumagai in the apparatus of Bhardwaj et al in view of Hatano and Redeker et al as an art recognized equivalent for the same purpose of generating a plasma. It is the Examiner's position that substitution of the inductive plasma source with microwave plasma source would have been obvious to one of ordinary skills in the art at the time of the invention. See MPEP 2144.06, Art Recognized Equivalent for the Same Purpose, Substituting Equivalents Known for the Same Purpose (in re Fout, 675 F.2d 297, 213 USPQ 532 (CCPA 1982)).

Claims 41-54 and 57-69 are rejected under 35 U.S.C. 103(a) as being unpatentable over Redeker et al (US Patent No. 6,182,602 B1) in view of Hatano (US Patent No. 5,989,345).

Redeker et al teaches a plasma CVD apparatus (Fig. 1) comprising:

a vacuum chamber 12 surrounded by a coil 74 coupled to an RF source 78 to induce a plasma in the chamber (*a second chamber, wherein the second chamber is configured to initially generate second plasma therein*), the chamber is further provided with a gas inlet port 18 through

which deposition gases (such as hydrocarbons) or etched gases can be introduced into the chamber (column 4, lines 1-22; column 5, lines 49-54); and

an inductively coupled plasma CVD apparatus (Fig. 1) including a remote plasma chamber cleaning system 30, wherein cleaning gases such as dissociated fluorine containing gases are introduced into a processing chamber 12 via a channel 28 for cleaning all exposed chamber surface (*a first chamber configured to generate a first plasma therein; wherein the second chamber is configured to receive the first plasma, wherein the first plasma is configured to restore said ability*) (abstract; column 4, lines 1-22).

Redeker et al fails to teach the deposition gas including an electrically conductive material such that deposition of the material on the interior surface of the chamber wall would ***inherently*** prevent inductive coupling of the power to the plasma (*the chamber further configured to lose an ability to generate the second plasma*).

Hatano teaches a process gas supply system (Fig. 1) for supplying a process gas into a process chamber, the system includes $TiCl_4$ (titanium tetrachloride gas) for forming Ti film on a substrate W set in a process chamber 6 (column 2, lines 51-62).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the process gas supply system as taught by Hatano in the apparatus of Bhardwaj et al in order to form a Ti film on a substrate.

Further regarding claim 42: the process chamber would *inherently* lose the ability to generate plasma as deposition of Ti on the interior surface of the processing chamber would prevent inductive coupling of energy from and inductive coil 70 into the plasma within the chamber. The process chamber would *inherently* regain the ability to generate plasma as

deposited Ti on the interior surface of the processing chamber is cleaned and removed by the remote plasma source.

Further regarding claims 43, 44 (tube furnace): the plasma processing chamber of Redeker is structurally equivalent to the claimed tube furnace because it includes a chamber configured to house a high density plasma. Similarly, the remote plasma source 30 of Redeker et al is a equivalent to tube furnace because it includes an applicator tube 508 such as sapphire tube or other energy transmissive tube therein a plasma is formed by a waveguide 512 (Fig. 18; column 18, line 51 through column 19, line 5).

Further regarding claims 45, 46: "a first structure defining a furnace …" is interpreted as the processing chamber; "a first material that is opaque to the wave …" is interpreted as a metallic material such as Ti; and "a delivery system in fluid communication …" is interpreted as the remote cleaning plasma source.

Further regarding claims 47, 48, 49: Redeker et al further teaches that the cleaning gas may be NF_3, F_2, SF_6, ClF_3, CF_4, C_2F_6 (column 19, lines15-39).

Further regarding claims 50-53: "an induction blocker" is interpreted as Ti deposited on the interior surface of the processing chamber; "a component coupled to the first reaction device and configured to …" is interpreted as the remote cleaning plasma source; and "an induction blocker remover" is interpreted as cleaning plasma gas introduced by the remote plasma source into the processing chamber. The processing chamber of Amens et al includes a quartz liner defining a processing chamber 25 and an induction coil 70 for generating an inductively coupled plasma within the processing chamber.

Further regarding claim 54: "a conduit configured to couple to an inductively-coupled plasma chamber" is interpreted as channel 28 in Figs. 1 and 18 of Redeker et al; "a cleaning chamber coupled to the conduit …) interpreted as the remote cleaning plasma source introducing a cleaning plasma gas into the processing chamber.

Further regarding claims 57, 60: "a reactor having a wafer fabrication mode …" or "a furnace comprising a quartz tube …" is interpreted the processing chamber; "a chamber configured to couple to the reactor during cleaning mode …) or "a cleaning chamber …" is interpreted as the remote cleaning plasma source introducing a cleaning plasma gas into the processing chamber.

Further regarding claim 58, 61, 62: removing the wafer from the processing chamber during cleaning is considered a process limitation and the apparatus of Amen I view of Redeker et al is capable of being used under the condition as recited in the claim.

Further regarding claim 59: "the chamber is configured to transmit said metal etchant in a non-plasma form from to said reactor during said cleaning mode" is considered a process limitation and the apparatus of Amen I view of Redeker et al *is capable of being operated* under the condition as recited in the claim by simply introducing the etchant through the remote cleaning plasma source without applying a plasma generating energy to the etchant.

Further regarding claims 63-66: "a conductive material present …" is interpreted as Ti deposited on the interior surface of the processing chamber; "a first plasma chamber" is interpreted as the remote cleaning plasma source.

Further regarding claims 67-69: "a first material that is opaque to a type of energy to an RF wave" is interpreted as Ti deposited on the interior surface of the processing chamber; "a

plasma delivery system ..." is interpreted as the remote cleaning plasma source which is used remove that Ti which is deposited on the interior surface of the processing chamber.

Claims 55, 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Redeker et al (US Patent No. 6,182,602 B1) in view of Hatano (US Patent No. 5,989,345) as applied to claims 41-54 and 57-69, and further in view of Kumagai (US Patent No. 5,916,455).

Redeker et al in view of Hatano teaches all limitations of the claims as discussed above except for the plasma generation device for the remote plasma source (cleaning chamber) being an inductively coupled plasma source rather than a microwave plasma source.

Kumagai teaches a plasma processing apparatus (Fig. 1) including a remote ignition plasma source 30 wherein an inductive coil 37 coupled to an RF power source 40 is used for generating a plasma (column 4, lines 8-29).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the inductive plasma device as taught by Kumagai in the apparatus of Redeker et al in view of Hatano as an art recognized equivalent for the same purpose of generating a plasma. It is the Examiner's position that substitution of the inductive plasma source with microwave plasma source would have been obvious to one of ordinary skills in the art at the time of the invention. See MPEP 2144.06, Art Recognized Equivalent for the Same Purpose, Substituting Equivalents Known for the Same Purpose (in re Fout, 675 F.2d 297, 213 USPQ 532 (CCPA 1982)).

Claims 41-54 and 57-69 are rejected under 35 U.S.C. 103(a) as being unpatentable over Redeker et al (US Patent No. 6,182,602 B1) in view of Amen et al (US Patent No. 5,834,371).

Redeker et al teaches a plasma CVD apparatus (Fig. 1) comprising:

a vacuum chamber 12 surrounded by a coil 74 coupled to an RF source 78 to induce a plasma in the chamber (*a second chamber, wherein the second chamber is configured to initially generate second plasma therein*), the chamber is further provided with a gas inlet port 18 through which deposition gases (such as hydrocarbons) or etched gases can be introduced into the chamber (column 4, lines 1-22; column 5, lines 49-54); and

an inductively coupled plasma CVD apparatus (Fig. 1) including a remote plasma chamber cleaning system 30, wherein cleaning gases such as dissociated fluorine containing gases are introduced into a processing chamber 12 via a channel 28 for cleaning all exposed chamber surface (*a first chamber configured to generate a first plasma therein; wherein the second chamber is configured to receive the first plasma, wherein the first plasma is configured to restore said ability*) (abstract; column 4, lines 1-22).

Redeker et al fails to teach the deposition gas including an electrically conductive material such that deposition of the material on the interior surface of the chamber wall would ***inherently*** prevent inductive coupling of the power to the plasma (*the chamber further configured to lose an ability to generate the second plasma*).

Amen et al teaches an inductively coupled plasma processing (Fig. 1) for forming a metallic film on a substrate using process gas supply system 11 including $TiCl_4$ (titanium tetrachloride gas) (column 5, line 45 through column 6, line 8; column 7, lines 60-65).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the process gas supply system as taught by Amen et al in the apparatus of Redeker et al in order to form a Ti film on a substrate.

Further regarding claim 42: the process chamber would *inherently* lose the ability to generate plasma as deposition of Ti on the interior surface of the processing chamber would prevent inductive coupling of energy from and inductive coil 70 into the plasma within the chamber. The process chamber would *inherently* regain the ability to generate plasma as deposited Ti on the interior surface of the processing chamber is cleaned and removed by the remote plasma source.

Further regarding claims 43, 44 (tube furnace): the plasma processing chamber of Redeker is structurally equivalent to the claimed tube furnace because it includes a chamber configured to house a high density plasma. Similarly, the remote plasma source 30 of Redeker et al is a equivalent to tube furnace because it includes an applicator tube 508 such as sapphire tube or other energy transmissive tube therein a plasma is formed by a waveguide 512 (Fig. 18; column 18, line 51 through column 19, line 5).

Further regarding claims 45, 46: "a first structure defining a furnace ..." is interpreted as the processing chamber; "a first material that is opaque to the wave ..." is interpreted as a metallic material such as Ti; and "a delivery system in fluid communication ..." is interpreted as the remote cleaning plasma source.

Further regarding claims 47, 48, 49: Redeker et al further teaches that the cleaning gas may be NF_3, F_2, SF_6, ClF_3, CF_4, C_2F_6 (column 19, lines15-39).

Further regarding claims 50-53: "an induction blocker" is interpreted as Ti deposited on the interior surface of the processing chamber; "a component coupled to the first reaction device and configured to …" is interpreted as the remote cleaning plasma source; and "an induction blocker remover" is interpreted as cleaning plasma gas introduced by the remote plasma source into the processing chamber. The processing chamber of Amens et al includes a quartz liner defining a processing chamber 25 and an induction coil 70 for generating an inductively coupled plasma within the processing chamber.

Further regarding claim 54: "a conduit configured to couple to an inductively-coupled plasma chamber" is interpreted as channel 28 in Figs. 1 and 18 of Redeker et al; "a cleaning chamber coupled to the conduit …) interpreted as the remote cleaning plasma source introducing a cleaning plasma gas into the processing chamber.

Further regarding claims 57, 60: "a reactor having a wafer fabrication mode …" or "a furnace comprising a quartz tube …" is interpreted the processing chamber; "a chamber configured to couple to the reactor during cleaning mode …) or "a cleaning chamber …" is interpreted as the remote cleaning plasma source introducing a cleaning plasma gas into the processing chamber.

Further regarding claim 58, 61, 62: removing the wafer from the processing chamber during cleaning is considered a process limitation and the apparatus of Amen I view of Redeker et al is capable of being used under the condition as recited in the claim.

Further regarding claim 59: "the chamber is configured to transmit said metal etchant in a non-plasma form from to said reactor during said cleaning mode" is considered a process limitation and the apparatus of Amen I view of Redeker et al *is capable of being operated* under

the condition as recited in the claim by simply introducing the etchant through the remote cleaning plasma source without applying a plasma generating energy to the etchant.

Further regarding claims 63-66: "a conductive material present ..." is interpreted as Ti deposited on the interior surface of the processing chamber; "a first plasma chamber" is interpreted as the remote cleaning plasma source.

Further regarding claims 67-69: "a first material that is opaque to a type of energy to an RF wave" is interpreted as Ti deposited on the interior surface of the processing chamber; "a plasma delivery system ..." is interpreted as the remote cleaning plasma source which is used remove that Ti which is deposited on the interior surface of the processing chamber.

Claims 55, 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Redeker et al (US Patent No. 6,182,602 B1) in view of Amen et al (US Patent No. 5,834,371) as applied to claims 41-54 and 57-69, and further in view of Kumagai (US Patent No. 5,916,455).

Redeker et al in view of Amen et al teaches all limitations of the claims as discussed above except for the plasma generation device for the remote plasma source (cleaning chamber) being an inductively coupled plasma source rather than a microwave plasma source.

Kumagai teaches a plasma processing apparatus (Fig. 1) including a remote ignition plasma source 30 wherein an inductive coil 37 coupled to an RF power source 40 is used for generating a plasma (column 4, lines 8-29).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the inductive plasma device as taught by Kumagai in the apparatus of Redeker et al in view of Amen et al as an art recognized equivalent for the same purpose of

generating a plasma. It is the Examiner's position that substitution of the inductive plasma source with microwave plasma source would have been obvious to one of ordinary skills in the art at the time of the invention. See MPEP 2144.06, Art Recognized Equivalent for the Same Purpose, Substituting Equivalents Known for the Same Purpose (in re Fout, 675 F.2d 297, 213 USPQ 532 (CCPA 1982)).

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Amen et al teaches an inductively coupled plasma processing (Fig. 1) comprising:

a reactor 15 including a sealed housing wall 26, quartz liner 70 defining a processing chamber 25, wherein a coil 70 coupled to an RF source 71 is provided between the housing 26 and quartz liner 70 for inductively coupling energy into the chamber 25 and form a plasma (*a second chamber, wherein the second chamber is configured to initially generate second plasma therein*), the chamber is further provided with a process gas supply system 11 including $TiCl_4$ (titanium tetrachloride gas) for forming Ti on a wafer (*the chamber further configured to lose an ability to generate the second plasma*) (column 5, line 45 through column 6, line 8; column 7, lines 60-65).

Amen et al fails to teach a remote plasma source configured for providing an etching (cleaning) gas into the processing chamber for cleaning an interior surface of the process chamber (*a first chamber configured to generate a first plasma therein; wherein the second*

chamber is configured to receive the first plasma, wherein the first plasma is configured to restore said ability).

Redeker et al teaches an inductively coupled plasma CVD apparatus (Fig. 1) including a remote plasma chamber cleaning system 30, wherein cleaning gases such as dissociated fluorine containing gases are introduced into a processing chamber 12 via a channel 28 for cleaning all exposed chamber surface (abstract; column 4, lines 1-22).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the remote plasma chamber cleaning system as taught by Redeker et al in the apparatus of Amen et al in order to clean the exposed chamber surface.

Further regarding claim 42: the process chamber would *inherently* lose the ability to generate plasma as deposition of Ti on the interior surface of the processing chamber would prevent inductive coupling of energy from and inductive coil 70 into the plasma within the chamber. The process chamber would *inherently* regain the ability to generate plasma as deposited Ti on the interior surface of the processing chamber is cleaned and removed by the remote plasma source.

Further regarding claims 43, 44 (tube furnace): the plasma processing chamber of Amen is structurally equivalent to the claimed tube furnace because it includes a quartz liner (tube) configured to house a high density plasma. Similarly, the remote plasma source 30 of Redeker et al is a equivalent to tube furnace because it includes an applicator tube 508 such as sapphire tube or other energy transmissive tube therein a plasma is formed by a waveguide 512 (Fig. 18; column 18, line 51 through column 19, line 5).

Further regarding claims 45, 46: "a first structure defining a furnace …" is interpreted as the processing chamber; "a first material that is opaque to the wave …" is interpreted as a metallic material such as Ti; and "a delivery system in fluid communication …" is interpreted as the remote cleaning plasma source.

Further regarding claims 47, 48, 49: Redeker et al further teaches that the cleaning gas may be NF_3, F_2, SF_6, ClF_3, CF_4, C_2F_6 (column 19, lines15-39).

Further regarding claims 50-53: "an induction blocker" is interpreted as Ti deposited on the interior surface of the processing chamber; "a component coupled to the first reaction device and configured to …" is interpreted as the remote cleaning plasma source; and "an induction blocker remover" is interpreted as cleaning plasma gas introduced by the remote plasma source into the processing chamber. The processing chamber of Amens et al includes a quartz liner defining a processing chamber 25 and an induction coil 70 for generating an inductively coupled plasma within the processing chamber.

Further regarding claim 54: "a conduit configured to couple to an inductively-coupled plasma chamber" is interpreted as channel 28 in Figs. 1 and 18 of Redeker et al; "a cleaning chamber coupled to the conduit …) interpreted as the remote cleaning plasma source introducing a cleaning plasma gas into the processing chamber.

Further regarding claims 57, 60: "a reactor having a wafer fabrication mode …" or "a furnace comprising a quartz tube …" is interpreted the processing chamber; "a chamber configured to couple to the reactor during cleaning mode …) or "a cleaning chamber …" is interpreted as the remote cleaning plasma source introducing a cleaning plasma gas into the processing chamber.

Further regarding claim 58, 61, 62: removing the wafer from the processing chamber during cleaning is considered a process limitation and the apparatus of Amen I view of Redeker et al is capable of being used under the condition as recited in the claim.

Further regarding claim 59: "the chamber is configured to transmit said metal etchant in a non-plasma form from to said reactor during said cleaning mode" is considered a process limitation and the apparatus of Amen I view of Redeker et al *is capable of being operated* under the condition as recited in the claim by simply introducing the etchant through the remote cleaning plasma source without applying a plasma generating energy to the etchant.

Further regarding claims 63-66: "a conductive material present …" is interpreted as Ti deposited on the interior surface of the processing chamber; "a first plasma chamber" is interpreted as the remote cleaning plasma source.

Further regarding claims 67-69: "a first material that is opaque to a type of energy to an RF wave" is interpreted as Ti deposited on the interior surface of the processing chamber; "a plasma delivery system …" is interpreted as the remote cleaning plasma source which is used remove that Ti which is deposited on the interior surface of the processing chamber.

Claims 55, 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Amen et al (US Patent No. 5,834,371) in view of Redeker et al (US Patent No. 6,182,602 B1) as applied to claims 41-54 and 57-69, and further in view of Kumagai (US Patent No. 5,916,455).

Amen et al in view of Redeker et al teaches all limitations of the claims as discussed above except for the plasma generation device for the remote plasma source (cleaning chamber) being an inductively coupled plasma source rather than a microwave plasma source.

Kumagai teaches a plasma processing apparatus (Fig. 1) including a remote ignition plasma source 30 wherein an inductive coil 37 coupled to an RF power source 40 is used for generating a plasma (column 4, lines 8-29).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the inductive plasma device as taught by Kumagai in the apparatus of Amen et al in view of Redeker et al as an art recognized equivalent for the same purpose of generating a plasma. It is the Examiner's position that substitution of the inductive plasma source with microwave plasma source would have been obvious to one of ordinary skills in the art at the time of the invention. See MPEP 2144.06, Art Recognized Equivalent for the Same Purpose, Substituting Equivalents Known for the Same Purpose (in re Fout, 675 F.2d 297, 213 USPQ 532 (CCPA 1982)).

Response to Arguments

Applicant's arguments with respect to claims 41-69 have been considered but are moot in view of the new ground(s) of rejection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Parviz Hassanzadeh whose telephone number is (703)308-2050. The examiner can normally be reached on Tuesday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory Mills can be reached on (703)308-1633. The fax phone numbers for the organization where this application or proceeding is assigned are (703)872-9310 for regular communications and (703)872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0661.

P. Hassanzadeh

Parviz Hassanzadeh
Examiner
Art Unit 1763

May 30, 2003